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LETTER TO THE EDITOR

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Please don't mow the Japanese knotweed!

Daniel Jones[1,2], Mike S. Fowler[1], Sophie Hocking[1], Daniel Eastwood[1]

1 *Department of Biosciences, Swansea University, Singleton Park, Swansea, SA2 8PP, UK* **2** *Advanced Invasives Ltd., Institute of Life Science 2, Swansea University, Singleton Park, SA2 8PP, UK*

Corresponding author: Daniel Jones (daniel.ll.jones@gmail.com)

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We welcome Martin et al.'s (2020) significant contributions toward advancing understanding of *Reynoutria japonica* var. *japonica* (Japanese knotweed) clonal growth strategies and resource allocation in response to environmental heterogeneity; understanding knotweed ecophysiology is essential to inform and enhance large-scale invasive knotweed management. However, we strongly disagree that mowing should be recommended for the landscape management of invasive knotweeds on the grounds of limited efficacy, practicality and environmental and economic sustainability. To achieve the successful control and long-term management of invasive rhizome-forming plants, we should do more with less, as the evidence guides us (Jones et al. 2018).

Invasive Knotweed Management

As Martin et al. (2020) state, Japanese knotweed is very difficult to control (Child 1999; Skibo 2007; Delbart et al. 2012; Jones et al. 2018). Mature invasive knotweeds (Japanese knotweed *s.l.* taxa) are physically large plants (above and belowground biomass regularly exceeds several kilograms per m^2, respectively) with extensive belowground growth (several metres in diameter and depth; Fennell et al. 2018; Jones et al. 2018). Depth and extent of belowground biomass affect management strategy by enabling

the plant to recover from many physical, herbicide-based and integrated control treatments, even when applied over relatively long time periods (>3 years; Jones et al. 2018).

While we acknowledge that mowing is a widely applied vegetation management method for infrastructure maintenance, cutting as a management method for established invasive knotweeds has been reported as ineffective in the medium to long-term at a range of spatial scales throughout the academic and grey literature in Europe and North America (Seiger 1997; Brabec and Pyšek 2000; Child and Wade 2000; Green 2003; CEH 2004; Soll 2004; Gover et al. 2005; Kabat et al. 2006; Rennocks 2007; Skibo 2007; Bashtanova et al. 2009; Macfarlane 2011; Delbart et al. 2012), though native species diversity may increase during active management (Adler 1993; Hartwig and Kiviat 2009).

Historically, where cutting was proposed as a management method in the UK and North America, it was suggested that Japanese knotweed stems were cut down to ground level at least every 2 to 3 weeks through the growing season to deplete belowground rhizomes (Child and Wade 2000; McHugh 2006; EA 2013). Yet, to our knowledge, there are no examples of successful long-term invasive knotweed management using this treatment programme, despite the application of approximately 20 cuts per year. While the 3 cuts per year proposed by Martin et al. is more economically sustainable than 20 applications, if the more intensive programme has not demonstrated efficacy at the field scale, it would seem unlikely that 3 cuts per year will deplete the rhizome sufficiently to achieve short-term control, let alone effective long-term management. Hujerová et al. (2013) and Van Evert et al. (2020) reported that aboveground cutting of taproot-forming *Rumex* spp. (Docks; also members of the Polygonaceae) three times per year did not eliminate these species from grassland, or result in plant death. This is despite Docks being smaller and less vigorous than any of the invasive knotweeds. Consequently, on the grounds of treatment efficacy alone, we do not recommend mowing as an effective management method for Japanese knotweed.

Aside from limited efficacy, consideration of practicality and the risk of further spread of Japanese knotweed in the environment should inform the application of mowing. Accessing large swathes of invaded riparian or roadside habitat with heavy equipment is frequently problematic, and it is crucial to ensure that stem and rhizome fragments created by cutting methods do not result in wider dispersal of knotweed into the environment (Sieger 1997; Child and Wade 2000; Soll 2004; McHugh 2006; Skibo 2007; Bashtanova et al. 2009; Macfarlane 2011; Delbart et al. 2012; EA 2013, Jones 2015). Minimising dispersal at the landscape scale is unfeasible, considering that leaf (Brabec 1997), stem (De Waal 2001) and rhizome fragments (weighing as little as 0.06 g; McFarlane 2011) may give rise to new plants. Further, Scott (1988), Beerling (1990) and Beerling et al. (1994) highlight direct lateral expansion of rhizome in response to cutting, exacerbating local spread. Causing the dispersal and/or exacerbating the spread of invasive knotweeds in the UK may be in contravention of national biodiversity legislation (e.g. The Wildlife and Countryside Act 1981, UK).

Parsimony as a principle for invasive plant management

There are strong environmental, ecological and economic arguments for the management of invasive alien plants (IAPs) to minimise their negative environmental and economic impacts (Pergl et al. 2020). However, limited empirical evidence underpinning the ecology and management of rhizome-forming invasive plants can lead to the application of ineffective and labour-intensive physical control treatments, and/or unnecessary/excessive herbicide use. This undermines the sustainability of long-term control programmes for these species, resulting in further spread and dispersal in the environment with no discernible management benefit (i.e. *'the cure is worse than the disease'*; Kettenring and Adams 2011; Jones et al. 2018; Jones and Eastwood 2019).

In short, to achieve the successful control and long-term management of invasive rhizome-forming plants, we should do more with less, as the evidence guides us (Jones et al. 2018). While we welcome Martin et al.'s significant contributions toward advancing understanding of Japanese knotweed belowground, in particular clonal growth strategies and resource allocation in response to environmental heterogeneity, we strongly disagree that mowing should be recommended for the landscape management of invasive knotweeds on the grounds of limited efficacy, practicality and environmental and economic sustainability.

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References

Adler C (1993) Growth and dispersal strategies and associations of the neophyte *Polygonum cuspidatum* with special regard to mowing. Tuexenia 13: 373–97.

Bashtanova UB, Beckett KP, Flowers TJ (2009). Review: Physiological Approaches to the Improvement of Chemical Control of Japanese Knotweed (*Fallopia japonica*). Weed Sci. 57: 584–592. https://doi.org/10.1614/WS-09-069.1

Beerling DJ (1990) The ecology and control of Japanese knotweed (Reynoutria japonica Houtt.) and Himalayan balsam (*Impatiens glandulifera* Royle) on river banks in South Wales. PhD thesis, University of Wales, Cardiff, UK

Beerling DJ, Bailey JP, Conolly AP (1994) *Fallopia japonica* (Houtt.) Ronse Decraene. J Ecol. 82: 959–979. https://doi.org/10.2307/2261459

Brabec J (1997) Experimental study of the effect of management on invasion of selected plant pieces into meadow communities. PhD Thesis, Charles University, Prague, Czech Republic

Centre for Ecology & Hydrology (CEH) (2004) Information Sheet 5: Japanese Knotweed. Centre for Aquatic Plant Management (CAMP) www.capm.org.uk [Accessed 21 March 2012]

Child L (1999) Vegetative Regeneration and Distribution of *Fallopia japonica* and *Fallopia* × *bohemica*: Implications for Control and Management. PhD Thesis, Loughborough University, Loughborough, UK

Child L, Wade M (2000) The Japanese Knotweed Manual: The Management and Control of an Invasive Weed. DPS Partnership Ltd, Burgess Hill

Delbart E, Mahy G, Weickmans B, Henriet F, Crémer S, Pieret N, Vanderhoeven S, Monty A (2012) Can Land Managers Control Japanese Knotweed? Lessons from Control Tests in Belgium. Environ Manage 50: 1089–1097. https://doi.org/10.1007/s00267-012-9945-z

De Waal LC (2001) A viability study of *Fallopia japonica* stem tissue. Weed Res. 40: 447–460. https://doi.org/10.1046/j.1365-3180.2001.00249.x

Environment Agency (EA) (2013) Managing Japanese Knotweed on Development Sites: The Knotweed Code of Practice. Environment Agency, Bristol

Fennell M, Wade M, Bacon KL (2018) Japanese knotweed (*Fallopia japonica*): an analysis of capacity to cause structural damage (compared to other plants) and typical rhizome extension. PeerJ 6:e5246. https://doi.org/10.7717/peerj.5246

Gover A (2005) Managing Japanese knotweed and giant knotweed on roadsides, Factsheet 5a. Penn State, Department of Horticulture, College of Agricultural Sciences, Roadside Research Project

Green S (2003) A review of the potential for the use of bioherbicides to control forest weeds in the UK. Forestry 76: 285–297. https://doi.org/10.1093/forestry/76.3.285

Hartwig T, Kiviat E (2009) Experimental Management of Japanese Knotweed (*Fallopia japonica*) on the Batavia Kill, Greene County, New York. Hudsonia Report to Greene County Soil and Water Conservation District & New York City Department of Environmental Protection

Hujerová R, Pavlů V, Hejcman M, Pavlů L, Gaisler J (2013) Effect of cutting frequency on above- and belowground biomass production of *Rumex alpinus*, *R. crispus*, *R. obtusifolius* and the *Rumex* hybrid (*R. patienta* × *R. tianschanicus*) in the seeding year. Weed Res. 53: 378–386. https://doi.org/10.1111/wre.12037

Jones D (2015) Japanese Knotweed *s.l.* Taxa and Introduced *Petasites* Species: Biosystematics, Ecology and Control. PhD Thesis, Swansea University, Swansea (UK)

Jones D, Bruce G, Fowler MS, Law-Cooper R, Graham I, Abel A, Street-Perrott FA, Eastwood D (2018) Optimising physiochemical control of invasive Japanese knotweed. Biol. Invasions 20: 2091–2105. https://doi.org/10.1007/s10530-018-1684-5

Jones D, Eastwood D (2019) Sustainable Control of Invasive Japanese Knotweed. Outlooks on Pest Management 30: 195–200. https://doi.org/10.1564/v30_oct_02

Kabat TJ, Stewart GB, Pullin AS (2006) Are Japanese knotweed (*Fallopia japonica*) control and eradication interventions effective? Centre for Evidence-Based Conservation (CEBC) Systematic Review No. 21

Kettenring KM, Adams CR (2011) Lessons learned from invasive plant control experiments: a systematic review and meta-analysis. J App Ecol 48: 970–979. https://doi.org/10.1111/j.1365-2664.2011.01979.x

Macfarlane J (2011) Development of strategies for the control and eradication of Japaneseknotweed. PhD Thesis, University of Exeter, Exeter (UK)

Martin F-M, Dommanget F, Lavallée F, Evette A (2020) Clonal growth strategies of *Reynoutria japonica* in response to light, shade, and mowing, and perspectives for management. NeoBiota 56: 89–110. https://doi.org/10.3897/neobiota.56.47511

McHugh JM (2006) A review of literature and field practices focused on the management and control of invasive knotweed (*Polygonum cuspidatum*, *P. sachalinense*, *P. polystachyum* and hybrids). The Nature Conservancy, Southern Lake Champlain Valley Program, West Haven, VT. http://www.invasive.org/gist/moredocs/polspp02.pdf [Accessed 07 November 2009]

Pergl J, Härtel H, Pyšek P, Stejskal R (2020) Don't throw the baby out with the bathwater – ban of glyphosate use depends on context. NeoBiota 56: 27–29. https://doi.org/10.3897/neobiota.56.51823

Rennocks L (2007) Knotweed Control: Implications for Biodiversity and Economic Regeneration in Cornwall. Duchy College, Rosewarne. http://www.cornwall.gov.uk/default.aspx?page=19740 [Accessed 15 February 2012]

Scott R (1988) A Review of Japanese Knotweed Control. NCC/NERC contract report, Cumbria

Seiger LA (1997) The Status of *Fallopia japonica* (*Reynoutria Japonica*; *Polygonum cuspidatum*) In *North America from Plant Invasions: Studies from North America and Europe*. Edited by Brock JH, Wade M, Pysek P, Green D. Backhuys Publishers, Leiden

Skibo A (2007) The Evaluation of Selected 'POST'-Applied Herbicides for Control of Japanese Knotweed (*Polygonum cuspidatum* syn. *Fallopia japonica* syn. Reynoutria japonica) and a Survey and Characterization of this Invasive Species in Delaware. PhD Thesis, University of Delaware, Delaware (US)

Soll J (2004) Controlling Knotweed (*Polygonum cuspidatum*, *P. sachalinense*, *P. polystachyum* and hybrids) in the Pacific Northwest. The Nature Conservancy, Oregon Field Office. http://www.invasive.org/gist/moredocs/polspp01.pdf [Accessed 03 September 2010]

Van Evert FK, Cockburn M, Beniers JE, Latsch R (2020) Weekly defoliation controls, but does not kill broad-leaved dock (*Rumex obtusifolius*). Weed Res. 60: 161–170. https://doi.org/10.1111/wre.12407